

Response

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Serial No.: 09/942,200

Confirmation No.: 8194

Filed: 29 August 2001

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME**Remarks**

The Office Action of March 8, 2006 has been received and reviewed. With no claims having been amended, added, or canceled, the pending claims remain claims 23, 25-27, 30-34, 37, and 41-49. While Applicant believes the comments provided in the previous response dated February 9, 2006 (which is incorporated herein by reference) are sufficient to overcome the pending rejections, the following additional remarks are provided below in an effort to move this application forward.

The 35 U.S.C. §103(a) Rejections

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

M.P.E.P. § 2143.

Claims 23, 25-27, 30-34, 37, 42, 44-45, 47 and 49

Claims 23, 25-27, 30-34, 37, 42, 44-45, 47, and 49 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. (U.S. Patent No. 5,744,832). Applicant traverses this rejection for at least the following reasons.

Independent claims 23, 27, 32, and 37 recite a platinum(x):ruthenium alloy, where "x is in the range of about 0.90 to about 0.98." As the Examiner again admits (*see Office Action*, page 2), Wolters et al. does not, among other deficiencies, disclose such a value of x. However, the Examiner asserts that "it would have been obvious to one of ordinary skill in the art . . . to modify Wolters by having the value of x being in the range of about 0.90 to about 0.98, since it has been held that where the general conditions of a claim are disclosed in the prior art discovering the optimum or working ranges involves only routine skill in the art." Applicant

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strenuously disagrees that it would be obvious to modify Wolters et al. in the manner proposed by the Office Action.

Wolters et al. is directed to "a method which results in a semiconductor device having a good electrical contact between the conducting region and the lower electrode," (Col. 3, Lns. 57-60). To achieve this goal, Wolters et al. teaches a method that provides alternately depositing platinum with a metal capable of forming a conductive oxide (*see, e.g.*, Col. 6 Lns 8-12). "Preferably, ruthenium is provided as the metal capable of forming a conductive oxide. A platinum layer with more than 15% ruthenium and a ruthenium oxide layer together form a very effective barrier against oxygen," (Col. 4, Lns. 15-19, emphasis added).

Accordingly, Wolters et al. describes a "layer 111 comprising platinum" that "contains more than 15 atom % of a metal capable of forming a conductive metal oxide [i.e., Ruthenium]," (*see, e.g.*, Col 5, Lns. 31-35, emphasis added).

To illustrate its invention, Wolters et al. demonstrates, in Figure 2, that platinum layers (111) having less than 15% atomic percentage ruthenium, (for example, in the illustration of Figure 2, approximately 10% ruthenium), result in an undesirable tungsten oxide layer being "formed at the boundary 4 between the conducting tungsten layer 5 and the layer 11" (Col. 5, Lns. 41-60). Figure 3, on the other hand, illustrates only a very small quantity of oxygen present at the boundary 4 for a ruthenium percentage above 15% (approximately 30% in the example of Figure 3).

Accordingly, Wolters et al. states that the layer 111 needs "more than 15 atom % of [ruthenium]" to be effective (Col. 5, Lns. 31-34). Obviously, a layer 111 having more than 15% ruthenium must necessarily have less than 90% platinum. In fact, the theoretical maximum content of platinum in the layer 111 would be only 85% (as the figures in Wolters et al. illustrate, the platinum concentration may be even less due to the presence of other materials (e.g., O, Ti, W) in the layer (see Figure 3)).

For at least this reason, Wolters et al. does not teach/suggest a platinum(x): ruthenium layer, wherein x is in the range of about 0.90 to about 0.98 as claimed. In fact, Wolters et al. clearly teaches away from such a concentration by suggesting use of a corresponding layer

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having less than 85 atomic percentage platinum. Wolters et al. illustrates that a layer having more than 85 atomic percentage platinum results in the formation of the undesirable tungsten oxide layer (see, e.g., description of Figure 2 of Wolters et al.). In other words, the modification of Wolters et al. suggested by the Office Action would clearly render Wolters et al. unsatisfactory for its intended purpose. As the M.P.E.P. makes clear, "[i]f proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification."

M.P.E.P. § 2143.01, citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

For these and other reasons, Applicant submits that amended independent claims 23, 27, 32, and 37 are not obvious over Wolters et al. Moreover, the rejected claims dependent upon these claims (e.g., claims 25, 26, 30, 31, 33, 34, and 42, 44, 45, 47, and 49) are also submitted to be patentable over Wolters et al. not only due to their dependence, but also because of the particular subject matter recited therein. Reconsideration and withdrawal of the rejection are requested.

Claims 41 and 46

Claims 41 and 46 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. in view of Bronner et al. (U.S. Patent No. 6,177,696). For the reasons already identified above, Wolters et al. fails to teach, or even suggest, the range of x recited in amended independent claims 23 and 37 (from which claims 41 and 46 respectively depend). Nothing is identified within the disclosure of Bronner et al. that remedies this deficiency. For at least this reason, reconsideration and withdrawal of the rejection are respectfully requested.

Claims 43 and 48

Claims 43 and 48 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. in view of Sandhu et al. (U.S. Patent No. 5,335,138). For the reasons already identified above, Wolters et al. fails to teach, or even suggest, the range of x recited in independent claims 23 and 37 from which claims 43 and 48 respectively depend. Nothing is

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identified within the disclosure of Sandhu et al. that remedies this deficiency. For at least this reason, reconsideration and withdrawal of the rejection are respectfully requested.

Comments on "Response to Arguments"

In the "Response to Arguments" section of the Office Action, the Examiner asserts that:

Wolters et al. merely teaches platinum contains more than 15 atom % of a metal capable of forming a conductive metal oxide. . . Further, Wolters et al. only shows in figure 2 the layer 11 comprises platinum, given an atomic percentage of approximately 10% ruthenium in platinum after heat treatment of 1 hour at 550C in an N₂/O₂ atmosphere . . . Therefore, Wolters et al. never teaches platinum *should not* contain less than 15 atom % of metal. As such, it would have been obvious . . . to modify Wolters et al. by having the value of x being about 0.95, since it has been held that where the general conditions of a claim are disclosed in the prior art[,] discovering the optimum or working ranges involves only routine skill in the art.

Emphasis in original.

First, Applicant submits that Figure 2 of Wolters et al. is provided to comparatively show that, when the layer 11 has an atomic percentage of ruthenium lower than 15%, e.g., approximately 10%, then the undesirable tungsten oxide layer will be formed. Thus, contrary to the assertions of the Office Action, Wolters et al. DOES SPECIFICALLY teach that the platinum layer "SHOULD NOT contain less than 15 atom percent" of the metal capable of forming the conductive metal oxide, i.e., ruthenium. As a result, the platinum layer may have no more than 85% platinum (theoretical) to be satisfactory for its intended purpose.

Even if one could consider the interpretation of Wolters et al. presented by the Office Action to satisfy the Office's *prima facie* burden, Applicant is permitted to rebut by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997). Applicant has rebutted the Office's assertions by illustrating that Wolters et al. clearly teaches away from the claimed invention (see remarks regarding obviousness above).

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Based at least upon these arguments, it is respectfully requested that the pending rejections be withdrawn.

Summary

It is submitted that the pending claims are in condition for allowance and notification to that effect is requested. The Examiner is invited to contact Applicant's Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted

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CERTIFICATE UNDER 37 CFR §1.8:

The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Commissioner for Patents, Mail Stop Amendment, P.O. Box 1450, Alexandria, VA 22313-1450, on this 31st day of MAY, 2006, at 2:55 pm (Central Time).

By: Kelly J. McNultyPrinted Name: Kelly J. McNulty